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5440-11 Mathematics (Revised ??/??/2016)

The holder is authorized to teach mathematics in grades 7-12.

1. **Content Knowledge**--Effective teachers of secondary mathematics know, understand, teach and communicate their mathematical knowledge with the breadth of understanding that reflects proficiency within and among the mathematical domains (Number, Algebra, Geometry, Trigonometry, Statistics, Probability, Calculus, and Discrete Mathematics) as outlined in the *NCTM NCATE Mathematics Content for Secondary*.
2. **Mathematical Practices**--Effective teachers of secondary mathematics:
 - 2.1. Demonstrate proficiency in using problem-solving as a vehicle for understanding mathematics by:
 - 2.1.1. Developing conceptual understanding of mathematical concepts through problem-solving
 - 2.1.2. Making sense of a wide variety of problems and persevering in solving them
 - 2.1.3. Applying various strategies to solve problems arising in mathematics and other contexts
 - 2.1.4. Formulating and testing conjectures to generalize mathematical phenomena
 - 2.2. Demonstrate proficiency in processes for doing mathematics by:
 - 2.2.1. Reasoning abstractly, reflectively, and quantitatively with attention to units
 - 2.2.2. Constructing and critiquing viable arguments and proofs
 - 2.2.3. Representing and modeling generalizations using mathematics
 - 2.2.4. Recognizing structure and expressing regularity in patterns of mathematical reasoning
 - 2.2.5. Using multiple representations to model and describe mathematics
 - 2.2.6. Organizing mathematical thinking and communicating ideas through appropriate mathematical vocabulary and symbols for multiple audiences
 - 2.2.7. Formulating, representing, analyzing, and interpreting mathematical models derived from real-world contexts and mathematical problems.
 - 2.3. Demonstrate an understanding of making mathematical connections by:
 - 2.3.1. Showing the interconnectedness of mathematical ideas and how they build on one another
 - 2.3.2. Applying mathematical connections among mathematical ideas and across various content areas and real-world contexts
3. **Content Pedagogy**--Effective teachers of secondary mathematics:
 - 3.1. Apply knowledge of curriculum standards for secondary mathematics and their relationship to student learning within and across mathematical domains.
 - 3.2. Analyze and consider research in planning for and leading students in rich mathematical learning experiences.

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- 3.3. Plan lessons and units that incorporate a variety of strategies, differentiated instruction for diverse populations, and mathematics-specific and instructional technologies in building all students' conceptual understanding and procedural proficiency.
- 3.4. Provide students with opportunities to communicate about mathematics and make connections among mathematics, other content areas, everyday life, and the workplace.
- 3.5. Implement techniques related to student engagement and communication including selecting high quality tasks, guiding mathematical discussions, identifying key mathematical ideas, identifying and addressing student misconceptions, and employing a range of questioning strategies.
- 3.6. Plan, select, implement, interpret, and use formative and summative assessments to inform instruction by reflecting on mathematical proficiencies essential for all students.
- 3.7. Monitor students' progress, make instructional decisions, and measure students' mathematical understanding and ability using formative and summative assessments.

For further exploration of Content Pedagogy, please see "Mathematical Teaching Practices" (from NCTM's *Principles to Actions: Ensuring Mathematical Success for All*).

4. **Mathematical Learning Environment**--Effective teachers of secondary mathematics:

- 4.1. Exhibit knowledge of adolescent learning, development, and behavior and demonstrate a growth mindset toward mathematical processes and learning.
- 4.2. Plan and create developmentally appropriate, sequential, and challenging learning opportunities grounded in mathematics education research in which students are actively engaged in building new knowledge from prior knowledge and experiences with connections between math and the real world.
- 4.3. Incorporate knowledge of individual differences and the cultural and language diversity that exists within classrooms and include culturally relevant perspectives as a means to motivate and engage students.
- 4.4. Demonstrate an understanding of how race, class, and gender can affect students' experiences with mathematics teaching and learning; actively combat stereotypes to avoid replication of historic patterns; and demonstrate a commitment to equitable treatment of and high expectations for all students.
- 4.5. Apply mathematical content and pedagogical knowledge to select and use instructional tools such as manipulatives and physical models, drawings, virtual environments, spreadsheets, presentation tools, and mathematics-specific technologies (e.g., graphing tools, interactive geometry software, computer algebra systems, and statistical packages); and integrate tools and technology as essential resources to help students learn and make sense of mathematical ideas, reason mathematically, and communicate their mathematical thinking.
- 4.6. Flexibly assess evidence of student mathematical proficiency for learning that takes place outside of the school, the school day, or the classroom.

5. **Impact on Student Learning**--Effective teachers of secondary mathematics:

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- 5.1. Verify that secondary students demonstrate conceptual understanding; procedural fluency; the ability to formulate, represent, and solve problems; logical reasoning and continuous reflection on that reasoning; productive disposition toward mathematics; and the application of mathematics in a variety of contexts within major mathematical domains.
 - 5.2. Promote personalization for each student, allowing students to demonstrate proficiency by presenting multiple types of evidence, including but not limited to teacher- or student-designed assessments, portfolios, performances, exhibitions and projects.
 - 5.3. Collect, organize, analyze, and reflect on diagnostic, formative, and summative assessment evidence, including authentic performance tasks and determine the extent to which students' mathematical proficiencies have increased as a result of their instruction.
 - 5.4. Convey how the development of mathematical theory and understanding is a historical process with continuous creation of new knowledge and the refinement of previous knowledge.
 - 5.5. Convey roles and responsibilities of mathematicians with respect to social, economic, cultural and political systems.
6. **Professional Knowledge and Skills**--Effective teachers of secondary mathematics:
- 6.1. Take an active role in their professional growth and maintain a current understanding of changes in the content and pedagogy of mathematics and learning theory by participating in professional learning experiences that directly relate to the learning and teaching of mathematics.
 - 6.2. Engage in continuous and collaborative learning that draws upon research in mathematics education to inform practice; enhance learning opportunities for all students' mathematical knowledge learning; involve colleagues, other school professionals, families, and various stakeholders; and advance their learning as a reflective practitioner.
 - 6.3. Demonstrate knowledge of misconceptions typically held by adolescents and effective methods for intervening to correct such misconceptions.
 - 6.4. Utilize resources from professional mathematics education organizations such as print, digital, and virtual resources/collections.

Additional Requirements:

A major in mathematics, or the equivalent in undergraduate and/or graduate coursework in mathematics (at least 30 hours of which at least 9 must be at the advanced undergraduate level or higher)

A minimum of a practicum, or the equivalent, at the middle/secondary level (7-12) in an endorsement requiring competencies with the Core Teaching Standards.

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This endorsement reflects the National Council for Teachers of Mathematics, *NCTM NCATE Standards--Secondary, 2012*, and The National Council for Teachers of Mathematics, *Principles to Actions: Ensuring the Mathematical Success for All, 2014*.

Contributors to this endorsement are:

Sue DeCarolus, Educational Consultant, Bomoseen, Vermont

Patrick Halladay, Coordinator of Professional Standards, Vermont Agency of Education

Karla Karstens, Senior Mathematics Lecturer, University of Vermont

Alan Matson, MathCounts Coach, Burlington

Kate McCann, Mathematics Teacher, U32 High School

Michael Ruppel, Mathematics Teacher, Springfield High School

Carmen Petrick Smith, Assistant Professor of Mathematics Education, University of Vermont

Tracy Watterson, PK-5 Mathematics Assessment Coordinator, Vermont Agency of Education

Katie Westby, Mathematics Teacher, Brattleboro Union High School

Lara White, 6-12 Mathematics Assessment Coordinator, Vermont Agency of Education

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